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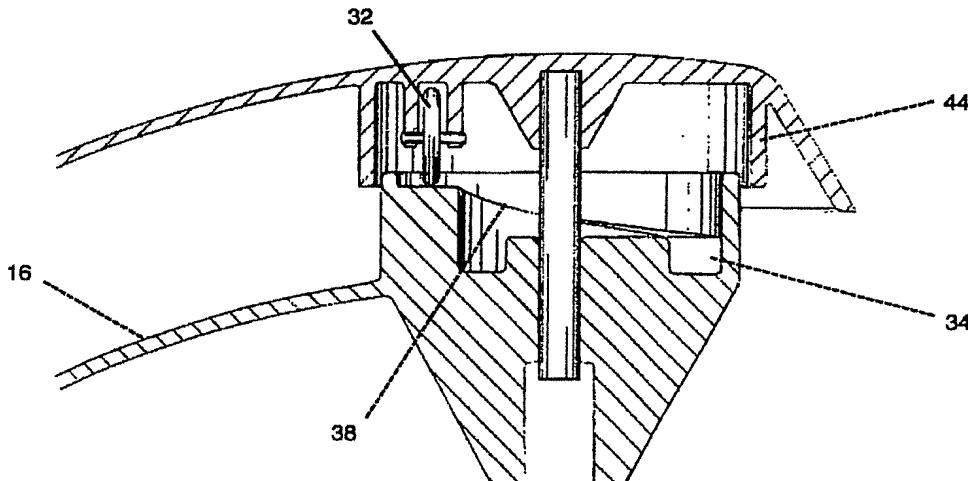
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(54) Title: SELF-SEALING CONTAINER



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(57) Abstract: An improved container, comprising a receptacle having an opening, a lid adapted to releasably cover at least a portion of the receptacle opening, the lid comprising a lower leaf (16) having a port through which the receptacle opening may be accessed, and an upper leaf (18) which, in a closed position, covers the port in the lower leaf (16), and which in an open position exposes at least a portion of the port, wherein the upper leaf rotates from the closed to the open position. A spiraling ramp (38) is fixed to one leaf, and engaged by a member (32) fixed to the other leaf, wherein the member (37) and the ramp (38) move relative to one another as the upper leaf (18) is moved from the closed position to the open position, and when the upper leaf (18) is moved from the open position to the closed position.

SELF-SEALING CONTAINER

FIELD OF THE INVENTION

This invention relates to refuse containers and more specifically to a container with a lid that automatically recloses.

BACKGROUND OF THE INVENTION

Although refuse containers are available in many shapes and sizes, these many shapes and sizes do not provide a means for disposing of refuse that is adequately sanitary, user friendly and maintains the refuse in the manner relatively free from once disposed. For example, the most basic refuse container with a lid consists of a receptacle with a hat-like lid that must be lifted using a knob or handle to throw waste into the receptacle. This design requires two hands and undesirably exposes the contents of the receptacle and may release odors associated with waste.

Another typical refuse container consists of a receptacle with a prism-shaped lid having a door that swings to and fro on a horizontal axis and is accessible from two sides. Although this design minimizes unwanted odors, does not unnecessarily expose the already disposed of waste and generally requires only one hand to push back the door, the refuse, as well as the user's hand which follows, invariably contacts the outside of the door, rendering this design unsanitary.

Yet another commonly used refuse container consists of receptacle with a dome-shaped or square-shaped lid having a spring-loaded door which must be firmly pushed inward to dispose of waste. Similar to the prism-shaped container, although this design reduces unwanted odors and keeps the refuse relatively free from view, the refuse, as well as the user's hand which follows, invariably contacts the outside of the door, rendering this design unsanitary. Oftentimes, the resistance of these spring-loaded doors is so high that an inordinate amount of pressure is required to push the door open and the user's hand frequently becomes trapped or otherwise pinched between the door and the inside surface of the container. Typically the user must use a second hand to hold the door open while dropping the waste in the container to prevent the door from prematurely closing. Furthermore, the user's hand necessarily must enter the container to an extent necessary to drop the waste in the receptacle.

SUMMARY OF THE INVENTION

It is therefore a primary object of this invention to provide a container that is sanitary and self-closing.

It is a further object of this invention to provide a lid for a refuse container that is sanitary and self-closing.

It is a further object of this invention to provide a refuse container that reduces odors, conceals unsightly waste already in the container, facilitates one-handed disposal and minimizes contact between the user's hands and the refuse already in the container.

This invention features an improved container, comprising: a receptacle having an opening; a lid adapted to releasably cover at least a portion of the receptacle opening, the lid comprising a lower leaf having a port through which the receptacle opening may be accessed, and an upper leaf which, in a closed position, covers the port in the lower leaf, and which in an open position exposes at least a portion of the port, wherein the upper leaf rotates from the closed to the open position; a spiraling ramp coupled to one leaf, and engaged by a member coupled to the other leaf, wherein the member and the ramp move relative to one another as the upper leaf is moved from the closed position to the open position, and when the upper leaf is moved from the open position to the closed position.

The leaf that carries the ramp may further comprise a depression for receiving the member when the upper leaf is in the closed position, to assist in maintaining the upper leaf in the closed position. The leaf that carries the ramp may further comprise a trough for receiving the member when the upper leaf is in the open position, to assist in maintaining the upper leaf in the open position. The upper leaf may further comprise an upper axle assembly, and the lower leaf may further comprise a lower axle assembly adapted to receive at least a portion of the upper axle assembly. The upper axle assembly may comprise a downwardly protruding axle, and the lower axle assembly may comprise an axle-receiving bore.

The ramp may comprise an energy absorbing member. The member may be a wheel. The member may be a tooth member. The improved container may further comprise an extension spring having two ends, one end secured to the lower leaf and the other end secured to the upper leaf. In this case, the improved container may further comprise a locking fastener provided with a shoulder and adapted to pass through the axle-receiving bore and fix to the upper axle assembly; and a compression spring provided about a portion of the locking fastener and juxtaposed between the shoulder and the axle support member.

The container may further comprise a means to prevent the upper leaf from over rotating. The means to prevent the upper leaf from over rotating may comprise an interference member fixed to the upper leaf, and a back stop provided in the lower leaf. The upper leaf may further comprise a security baffle. The ramp may be a part of the lower leaf. The ramp may be part of the upper leaf. The ramp may be bi-directional. The upper ends of

the bi-directional ramp may be proximate one another. The container may further comprise a depression proximate the upper ends of the bi-directional ramp, to receive the member to hold the upper leaf in the open position.

Also featured is an improved container, comprising: a receptacle having a circular upper edge and an opening; a lid adapted to releasably cover at least a portion of the receptacle opening, the lid comprising a lower leaf having a circular lower edge resting on the receptacle upper edge and defining a plane, and having a port through which the receptacle opening may be accessed, and an upper leaf which, in a closed position, covers the port in the lower leaf, and which in an open position exposes at least a portion of the port, wherein the upper leaf rotates about an axis which is substantially perpendicular to the plane, from the closed to the open position; a spiraling ramp fixed to the lower leaf, and engaged by a rolling wheel fixed to the upper leaf, wherein the wheel moves up the ramp as the upper leaf is moved from the closed position to the open position, and moves down the ramp when the upper leaf is moved from the open position to the closed position.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages will occur to those skilled in the art from the following description of the preferred embodiments and the accompanying drawings in which:

FIG. 1A is a perspective view of a preferred embodiment of the container of the invention;

FIG. 1B is a top view of the container of FIG. 1A;

FIG. 1C is an enlarged partial cross-sectional view of the container of FIG. 1B;

FIG. 2A is a partial perspective view of the container of FIG. 1A, partially opened;

FIG. 2B is a top view of the container of FIG. 2A;

FIG. 2C is an enlarged partial cross-sectional view of the container of FIG. 2B;

FIG. 3A is a partial perspective view of the container of FIG. 1A, fully opened;

FIG. 3B is a top view of the container of FIG. 3A;

FIG. 3C is an enlarged partial cross-sectional view of the container of FIG. 3B;

FIG. 4 is a perspective view of the bottom of the upper leaf of the container of FIG. 1A;

FIG. 5 is a perspective view of the top of the lower leaf of the container of FIG. 1A;

FIG. 6A is a partial perspective view of another preferred embodiment of the container of the invention;

FIG. 6B is a top view of the container of FIG. 6A;

FIG. 6C is an enlarged partial cut-out view of the container of FIG. 6A;
FIG. 6D is an enlarged partial cross-sectional view of the container of FIG. 6B;
FIG. 7A is a partial perspective view of the container of FIG. 6A, partially open;
FIG. 7B is a top view of the container of FIG. 7A;
FIG. 7C is an enlarged partial cut-out view of the container of FIG. 7B;
FIG. 8A is a partial perspective view of the container of FIG. 6A in the open position;
FIG. 8B is a top view of the container of FIG. 8A;
FIG. 8C is an enlarged partial cut-out view of the container of FIG. 8B;
FIG. 9A is an enlarged partial perspective view of the container of FIG. 6A in a locked open position;
FIG. 9B is a top view of the container of FIG. 9A;
FIG. 10 is an exploded view of the container of FIG. 6A;
FIG. 11A is a side view of the container of FIG. 6A;
FIG. 11B is a side view of the container of FIG. 11A with the lid up;
FIG. 12A is an enlarged, partial view of the container of FIG. 11A, featuring the hinge assembly;
FIG. 12B is a cross-sectional view of the container and hinge as shown in FIG. 12A;
FIG. 13 is a cross-sectional view of the container as shown in FIG. 6A in a closed position;
FIG. 14 is a cross-sectional view of the container as shown in FIG. 8A in the opened position;
FIG. 15 is a perspective view of the top of the lower leaf of the container as shown in FIG. 5 further comprising a wheel trough and an energy absorbing member;
FIG. 16 is a perspective view of the container illustrating an example of plane A as defined by the perimeter of the lower leaf;
FIG. 17A and 17B are views similar to those of FIGS. 4 and 5 for an alternative preferred embodiment with a bi-directional spiraling ramp and a depression at the tops of the ramps to hold the top leaf in the open position; and
FIG. 18 is a partial view of an alternative embodiment with the spiraling ramp on the upper leaf and the ramp-engaging wheel on the lower leaf.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The container of the invention is adapted to automatically close and to self-seal upon closure. More specifically, the invention may be accomplished in a receptacle and a unique lid comprising an upper leaf and a lower leaf which are joined along a vertical axis assembly

which enables the top leaf to rotate about the vertical axis when opening and closing. In the first embodiment described below, after being rotated to an open position, the upper leaf recloses and self-seals by a gravity driven mechanism. The second preferred embodiment closes and self-seals by a spring-loaded mechanism. In both of the preferred embodiments there is a spiraling ramp on one leaf and a ramp-engaging member on the other leaf. The upper leaf is effectively raised and lowered due to the spiraling action of the ramp engaging member as it moves up and down the ramp. The spiraling action may be upward and downward or inward and outward depending on the orientation of the leaves relative to the receptacle.

FIGS. 1 and 2 show a preferred embodiment of the container of the invention, which closes and self-seals by a gravity driven mechanism, generally referred to as container 10 and which is generally intended for, although not limited to, use as a refuse container. Container 10 is characterized by receptacle 12 having a opening (not shown) and lid 14 which covers the opening of receptacle 12. Lid 14 has a lower leaf 16 and an upper leaf 18 with handle 20. The perimeter of lower leaf 16 generally follows the shape of the upper edge of receptacle 12, which in the embodiment shown is round and is also the shape of the opening in receptacle 12. Lower leaf 16 is provided with a port 36 (FIGS. 2A and 3A) through which receptacle 12 is accessed when the lid is open. The upper edge of the perimeter of lower leaf 16 generally defines plane A (FIG. 16). Upper leaf 18 in a closed position, as shown in FIG. 1A, should completely cover port 36. Upper leaf 18 is provided with an upper axle assembly 26 (FIG. 4) and lower leaf 16 is provided with a lower axle assembly 30 (FIG. 5).

Upper leaf 18 is adapted to rotate about axis X (FIG. 1C) by a means of rotating. Axis X is substantially perpendicular to the plane defined by the perimeter of lower leaf 16. The term "substantially perpendicular" is used to distinguish the axis X from an axis that is substantially parallel to a plane defined by the perimeter of the lower leaf. For example, as described in the Background section, some known refuse containers comprise a receptacle with a prism-shaped lid having a door that swings to and fro on a horizontal axis. In contrast, the vertically positioned axis of the present design enables the upper leaf to be adapted for use at any number of locations relative to the lower leaf. Axis X may be somewhat off a truly perpendicular line to accommodate modified receptacle and lid shapes.

As shown in FIGS. 1C, 4 and 5, the means for rotating includes ramp 38, which is an integral part of lower axle assembly 30, and wheel 32 which is attached to wheel guides 48 by wheel axle 31, and which, in a closed position, rests in depression 34. When handle 20 is pushed backwards, wheel 32 is lifted up out of depression 34 and rolls upward along ramp

38. The lid is also provided with a means to prevent the upper leaf from over rotating (FIGS. 4 and 5), comprising, interference member 42, which is a protrusion extending downward from the inside surface of upper axle assembly 26 into channel 52 provided in lower axle assembly. As the upper leaf is pushed backward, interference member 42 moves through channel 52 until interference member butts up against backstop 50.

As noted, upper leaf 18 rotates about axis X. To accomplish the rotation, upper axle assembly includes a vertical axle 24 extending downward from the top inside surface of the upper axle assembly. A corresponding axle support member 28 is provided in lower axle assembly 30. Axle support member 28 is a bore having an inside diameter of sufficient breadth to receive axle 24 there through without undue clearance.

As shown in FIG. 15, an energy absorbing member 39 may be incorporated into the upper end of ramp 38 to absorb the rotational energy of the upper leaf. Trough 41, defined by backwall 43 and energy absorbing member 39 may also be included and serves to releasably hold the upper leaf in an open position. In normal operation, the upper leaf is pushed open and gravity returns the upper leaf to its closed position when the upper leaf is released. If the upper leaf is rotated with additional force, wheel 32 will drop into trough 41 and remain immobilized until the upper leaf is deliberately rotated in the opposite direction to overcome energy absorbing member 39. The energy absorbing member effectively suspends the upper leaf in an open position for the longest possible period of time before gravity returns the upper leaf to a closed position. Trough 41 makes it possible to leave the upper leaf in an open position indefinitely when needed.

FIGS. 2A - 2C show the container wherein upper leaf 18 has been rotated open approximately 35 degrees. In this position, wheel 32 has been forced to ride up out of depression 34 in the lower assembly and the entire upper leaf 18 has been raised as shown by clearance area 40. As shown in FIGS. 3A - 3C, upper leaf 18 is rotated approximately 180 degrees to its full extent. Gravity will then drive wheel 32 of the upper leaf back down ramp 38 to drop back into depression 34 to remain in the closed position until handle 20 is pushed backward again. Baffles 44 define the perimeter of the upper axle assembly and serve to prevent debris from entering the interior mechanism of the upper and lower axle assemblies.

The invention is used by rotating the handle with the user's hand in a counterclockwise direction. In response, the upper leaf rolls on the wheel, up the ramp in the axis assembly. This rotating and lifting action of the upper leaf exposes the opening in the receptacle. When the handle is released, gravity causes the wheel to roll back down the ramp so that top leaf returns to the closed and sealed position. As the wheel rolls down the ramp to

seat in the depression, the upper leaf is lowered to create a seal between the upper and lower leaves.

The handle is typically contacted and pushed by the back of the user's hand while the refuse is dropped into the opening. This design achieves a more sanitary receptacle than the conventional flip door lids wherein the door and the user's hand enter the receptacle to some extent and wherein the refuse usually contacts the door, as well as the user's hand. Thus, the unique handle of the invention, together with the minimal resistance of the lid's vertical axis assembly, provides for a clean, one-handed disposal of the refuse.

Another preferred embodiment of the container of the invention is shown in FIGS. 6A - 10 and generally referred to as container 60. Similar to container 10, container 60 is characterized by receptacle 63 having a opening (not shown) and lid 65 which covers the opening of receptacle 63. Lid 65, likewise, has a lower leaf 62 and an upper leaf 64 with handle 66. Lower leaf 62 is provided with a port 86 (FIGS. 7A, 8A and 9A) through which receptacle 63 is accessed when the lid is open. Upper leaf 64 is provided with an upper axle assembly 71 (FIG. 6D) and lower leaf 62 is provided with a lower axle assembly 73 (FIG. 6D).

Upper leaf 64 is adapted to rotate about axis Y (FIG. 6D) by a means of rotating. Container 60's means of rotating differs from that of container 10. Container 60's means of rotating comprises extension spring 76 having two ends, the first of which is secured to lower axle assembly with fastener 74, and the second of which is secured to upper axle assembly with fastener 72. In a clockwise direction from lower fastener 74 to upper fastener 72, extension spring 76 circumscribes the upper portion of vertical axle 78. The means of rotating further comprises tooth member 68, which is integral with baffle 92 of upper axle assembly 71 and adapted to slide up ramp 70 out of depression 69 when handle 66 is pushed backwards.

Lid 65 is also provided with threaded, locking fastener 84 which is passed up through conduit 94 and compression spring 82 within inner chamber wall 80 of lower axle assembly 73 and fixed to upper axle assembly by corresponding threads on the inside surface of inner chamber wall 83 of upper axle assembly 71. As locking fastener 84 is partially screwed into chamber wall 83, vertical axle 78 is guided into circular channel 77 defined by the outer wall of conduit 94 and inner chamber wall 80. Compression spring 82 is squeezed between the lower head 85 of the locking fastener and inner annular shoulder 87 provided at the top end of inner chamber wall 80, which thus exerts a downwards pressure on the upper leaf at the point of connection between locking fastener 84 and the threads on the inside surface of

chamber wall 83 of upper axle assembly 71. The locking fastener and the compression spring together act to increase the force of the seal between the upper and lower leaves. However, depending on the materials used to make the lid, the weight of the upper leaf may be sufficient to create an adequate seal.

As shown in FIGS. 7A - 7C, upper leaf 64 is partially rotated about its axis so that tooth member 68 is sliding up ramp 70 to reveal a small portion of port 86 through lower leaf 62. As shown in FIGS. 8A - 8C, upper leaf 64 is rotated even more to expose a greater portion of port 62 and raised up to create a clearance space 88 between the upper and lower leaves to facilitate easy rotation. Likewise, compression spring 82 is more fully compressed and extension spring 76 is more fully extended. FIGS. 9A and 9B show the lid of the container in a locked open position wherein the upper leaf will not return to a closed position until enough force is exerted on the handle to overcome the resistance mechanism, e.g. trough 41 shown in FIG. 15.

The container of the invention may also be provided with a hinge mechanism to hold the entire lid in an upright, open position to allow the contents of the receptacle to be removed or a refuse bag replaced. For example, as shown in FIGS. 11A - 12B, hinge mechanism 96 is fixed to the lid and the receptacle. The hinge mechanism may be integral with the lid, e.g. a living hinge 98, or a separate fixture attached to the lid and to the receptacle. Hinge mechanism 96 is attached in the wall of receptacle 63 using bolts 100. Space 102 is created between the upper edge of receptacle 63 and the hinge attachment to allow for excess bag material. Cleat-like member 104 allows a bag to be pulled tight around the lip of the receptacle.

An alternative preferred embodiment is shown in FIGS. 17A and B. This embodiment includes a bi-directional ramps 38a and 38b, with wheel-receiving depression 39 proximate the upper ends of the ramps. The ramps are more drastically sloped at their upper ends to provide a natural stop when the lid is pushed open relatively softly. A slightly harder force is necessary to urge the wheel over the end of the ramp to drop the wheel into depression 39, which holds the lid open until the lid is pushed hard enough to force the wheel back over the top of a ramp, so that the wheel then rolls down to the end of the ramp, thereby closing the container.

FIG. 18 depicts partially, and very schematically, a reversed arrangement, with wheel 32 on the fixed cover leaf and wheel-engaging spiraling ramp 38 on the upper, rotatable leaf. This reversed construction achieves the same result as the previously-described embodiments.

As noted, the container of the invention is not limited to a refuse container. The container may be adapted for virtually any type of container including, but not limited to, bulk food containers and laundry hampers. The size, shape and type of materials used to make the container will depend on the application.

Although specific features of the invention are shown in some drawings and not others, this is for convenience only as some feature may be combined with any or all of the other features in accordance with the invention.

Other embodiments will occur to those skilled in the art and are within the following claims:

What is claimed is:

1. An improved container, comprising:
 - a receptacle having an opening;
 - a lid adapted to releasably cover at least a portion of the receptacle opening, the lid comprising a lower leaf having a port through which the receptacle opening may be accessed, and an upper leaf which, in a closed position, covers the port in the lower leaf, and which in an open position exposes at least a portion of the port, wherein the upper leaf rotates from the closed to the open position; and
 - a spiraling ramp coupled to one leaf, and engaged by a member coupled to the other leaf, wherein the member and the ramp move relative to one another as the upper leaf is moved from the closed position to the open position, and when the upper leaf is moved from the open position to the closed position.
2. The improved container of claim 1 wherein the leaf that carries the ramp further comprises a depression for receiving the member when the upper leaf is in the closed position, to assist in maintaining the upper leaf in the closed position.
3. The improved container of claim 1 wherein the leaf that carries the ramp further comprises a trough for receiving the member when the upper leaf is in the open position, to assist in maintaining the upper leaf in the open position.
4. The improved container of claim 1 wherein the upper leaf further comprises an upper axle assembly, and the lower leaf further comprises a lower axle assembly adapted to receive at least a portion of said upper axle assembly.
5. The improved container of claim 4 wherein the upper axle assembly comprises a downwardly protruding axle, and the lower axle assembly comprises an axle-receiving bore.
6. The improved container of claim 1 wherein the ramp comprises an energy absorbing member.
7. The improved container of claim 1 wherein the member is a wheel.
8. The improved container of claim 1 wherein the member is a tooth member.
9. The improved container of claim 1 further comprising an extension spring having two ends, one end secured to the lower leaf and the other end secured to the upper leaf.
10. The improved container of claim 5, further comprising:
 - a locking fastener provided with a shoulder and adapted to pass through the axle-receiving bore and fix to the upper axle assembly; and

a compression spring provided about a portion of the locking fastener and juxtaposed between the shoulder and the axle support member.

11. The improved container of claim 1, further comprising means to prevent the upper leaf from over rotating.

12. The improved container of claim 11, wherein the means to prevent the upper leaf from over rotating comprises an interference member fixed to the upper leaf, and a back stop provided in the lower leaf.

13. The improved container of claim 1, wherein the upper leaf further comprises a security baffle.

14. The improved container of claim 1 wherein the ramp is a part of the lower leaf.

15. The improved container of claim 1 wherein the ramp is part of the upper leaf.

16. The improved container of claim 1 wherein the ramp is bi-directional.

17. The improved container of claim 16 wherein the upper ends of the bi-directional ramp are proximate one another.

18. The improved container of claim 17 further comprising a depression proximate the upper ends of the bi-directional ramp, to receive the member to hold the upper leaf in the open position.

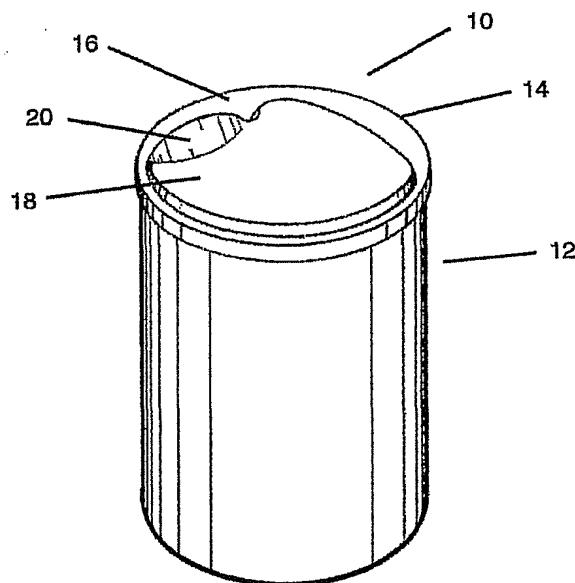
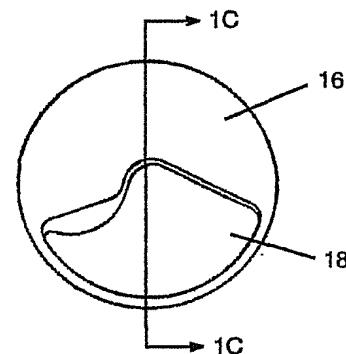
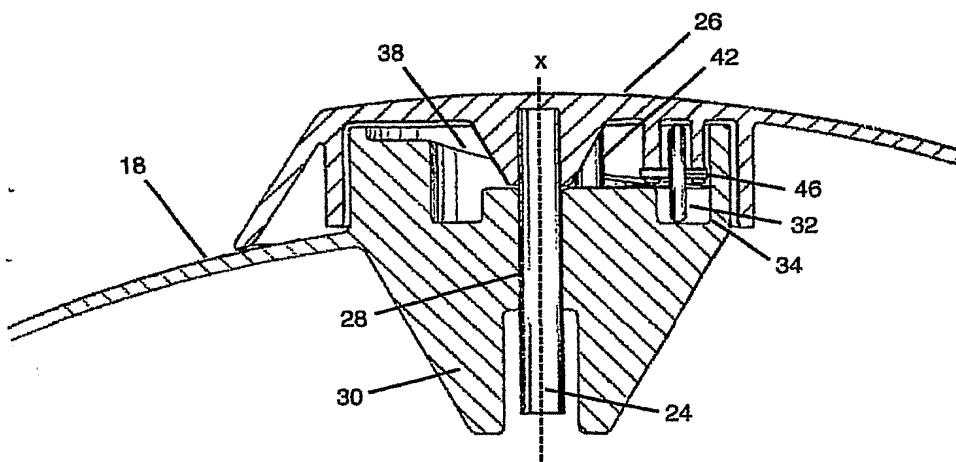
19. An improved container, comprising:

a receptacle having a circular upper edge and an opening;

a lid adapted to releasably cover at least a portion of the receptacle opening, the lid comprising a lower leaf having a circular lower edge resting on the receptacle upper edge and defining a plane, and having a port through which the receptacle opening may be accessed, and an upper leaf which, in a closed position, covers the port in the lower leaf, and which in an open position exposes at least a portion of the port, wherein the upper leaf rotates about an axis which is substantially perpendicular to the plane, from the closed to the open position;

a spiraling ramp fixed to the lower leaf, and engaged by a rolling wheel fixed to the upper leaf, wherein the wheel moves up the ramp as the upper leaf is moved from the closed position to the open position, and moves down the ramp when the upper leaf is moved from the open position to the closed position.

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**FIG. 1A****FIG. 1B****FIG. 1C****SUBSTITUTE SHEET (RULE 26)**

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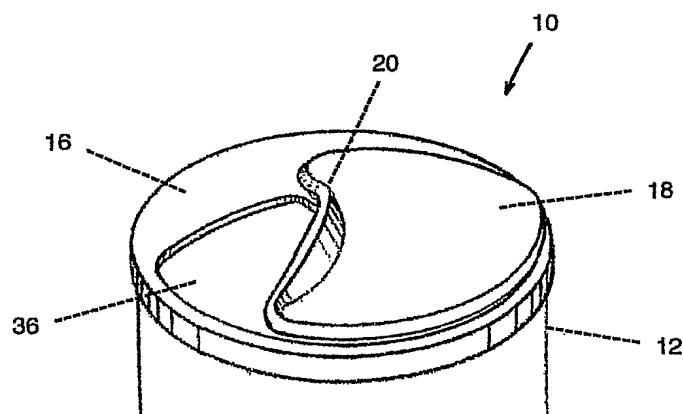


FIG. 2A

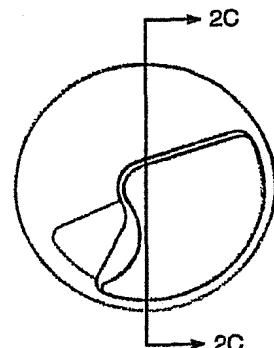


FIG. 2B

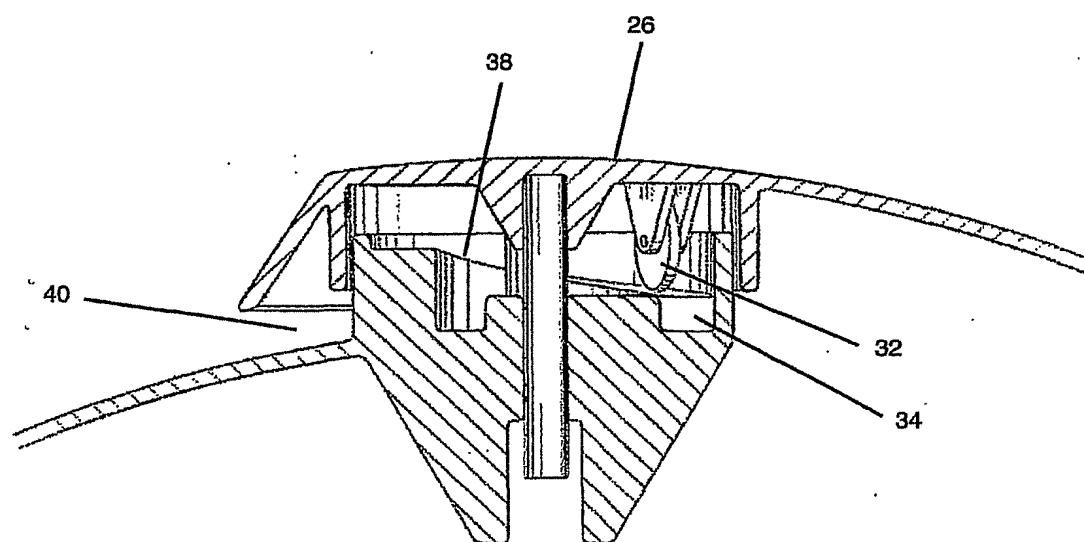


FIG. 2C

SUBSTITUTE SHEET (RULE 26)

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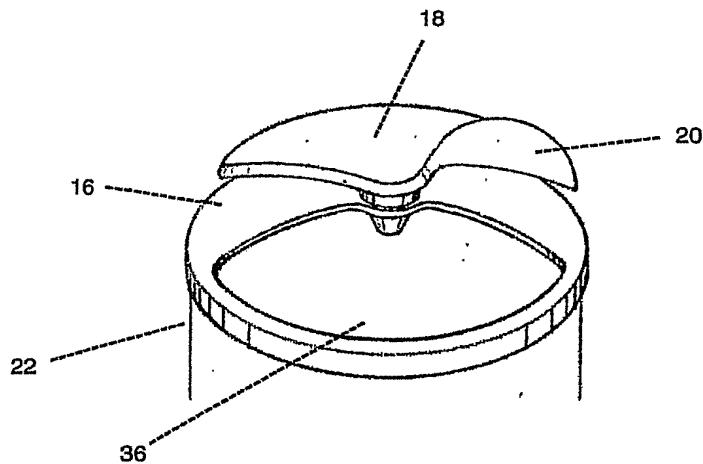


FIG. 3A

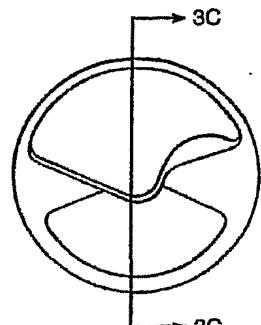


FIG. 3B

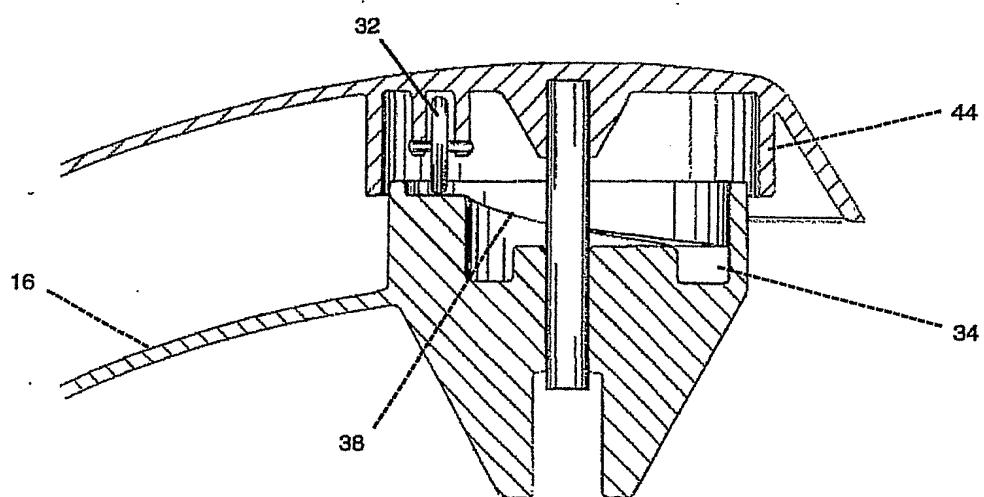


FIG. 3C

SUBSTITUTE SHEET (RULE 26)

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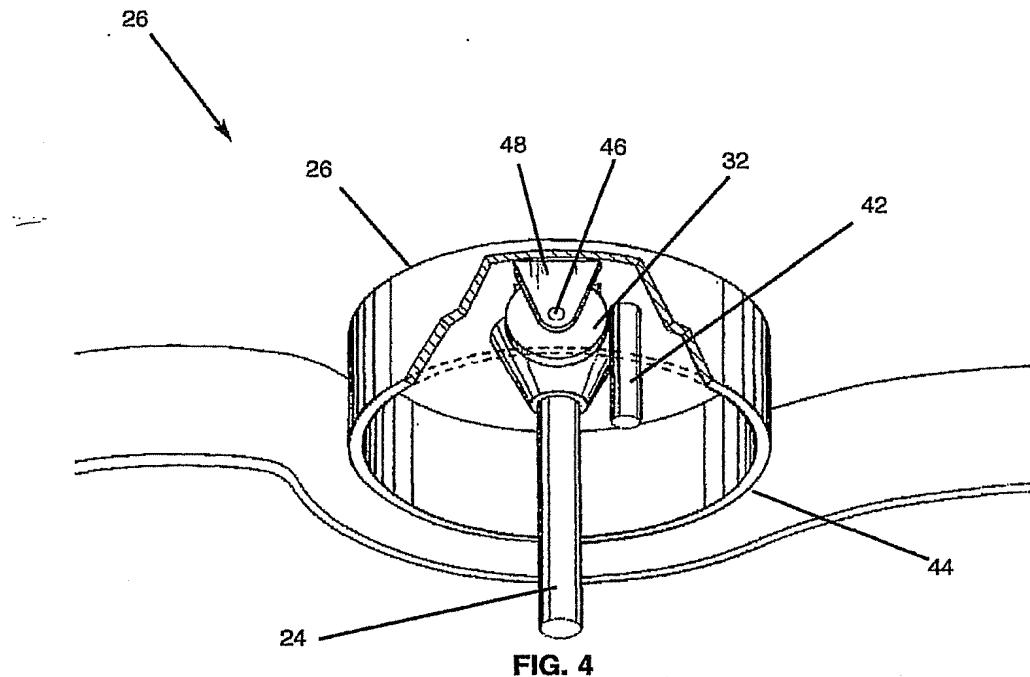


FIG. 4

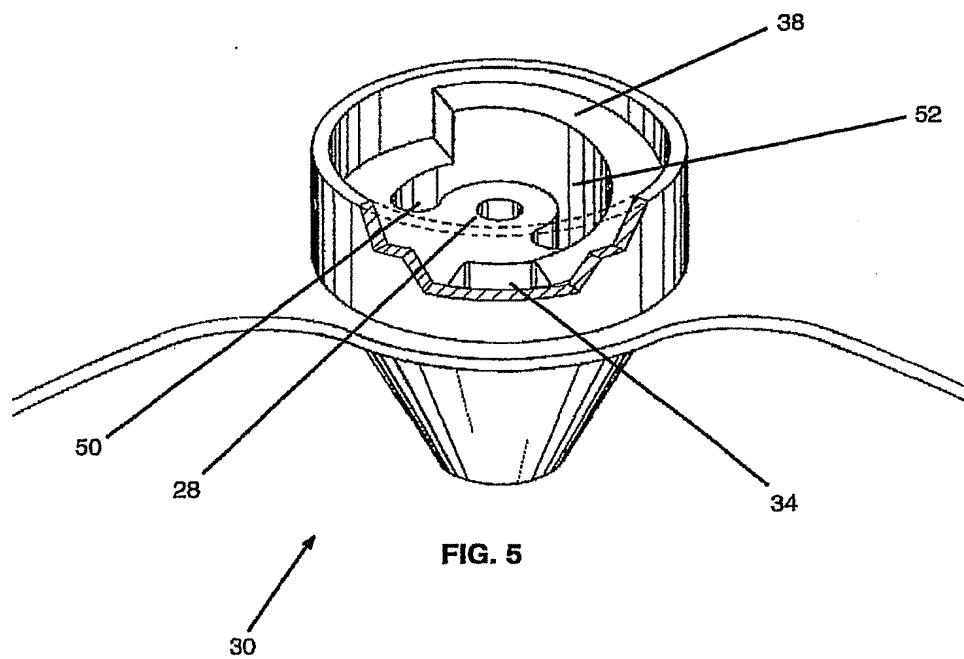


FIG. 5

SUBSTITUTE SHEET (RULE 26)

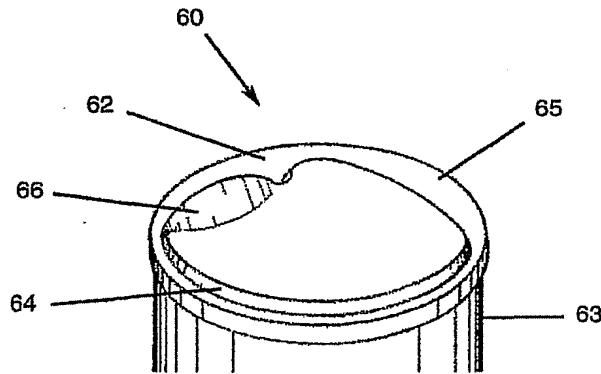


FIG. 6A

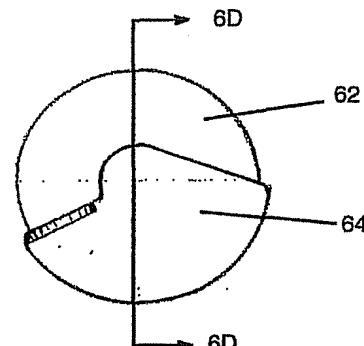


FIG. 6B

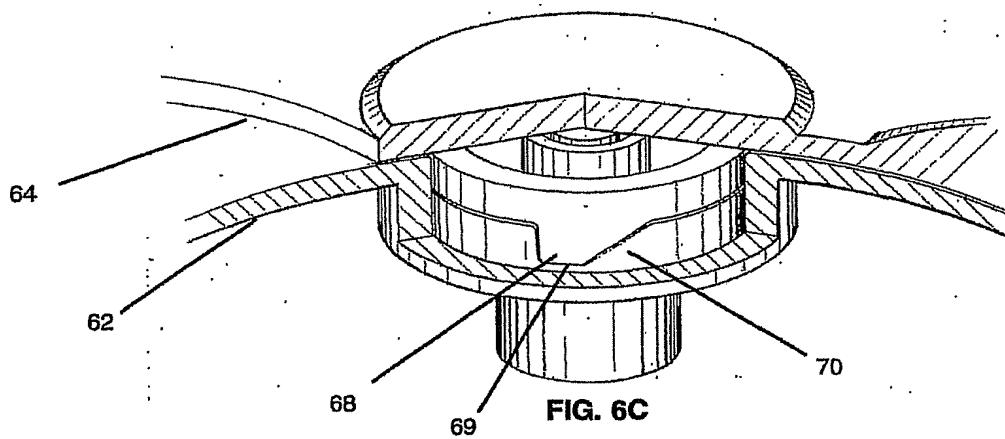


FIG. 6C

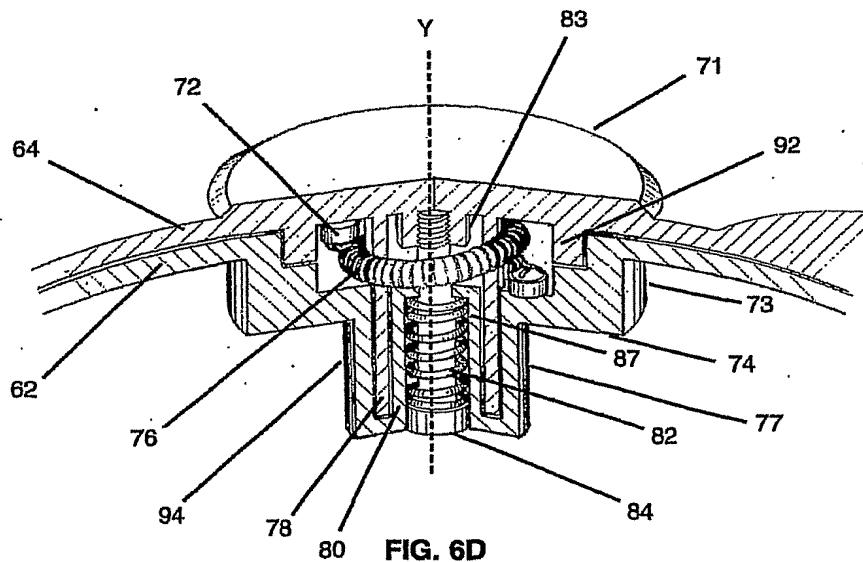


FIG. 6D

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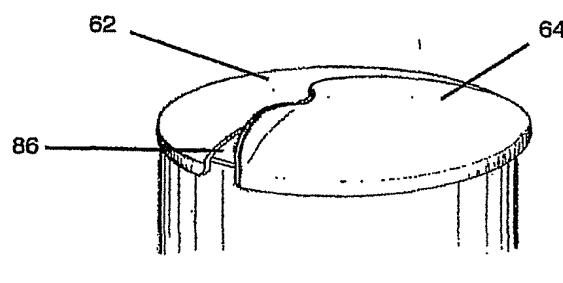


FIG. 7A

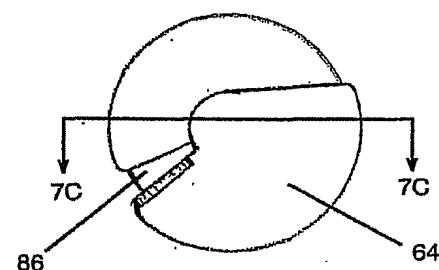


FIG. 7B

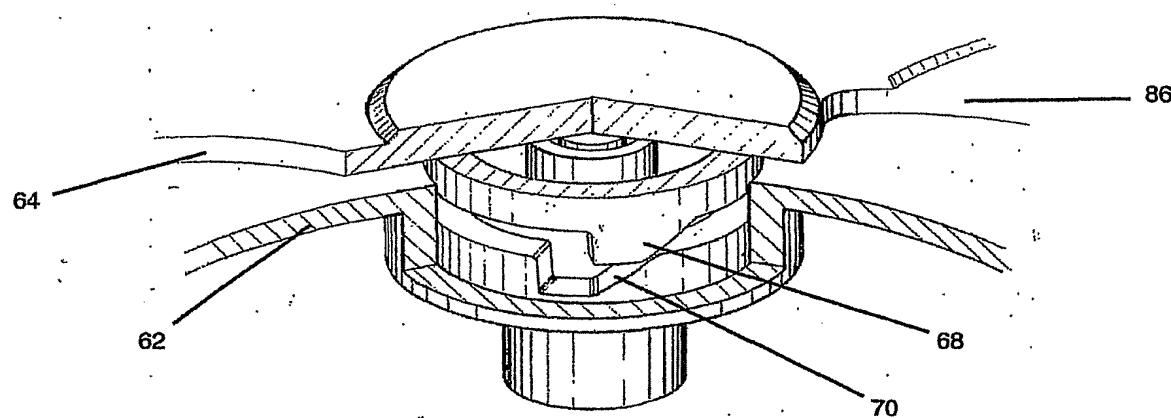


FIG. 7C

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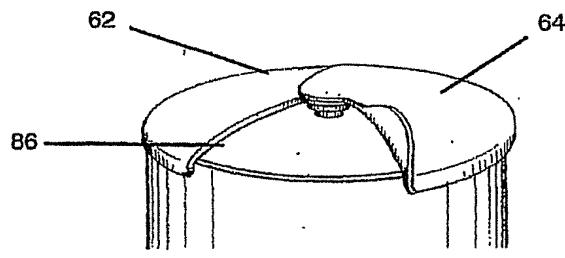


FIG. 8A

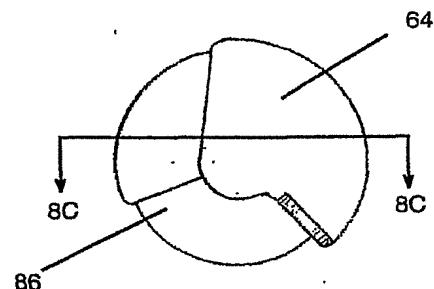


FIG. 8B

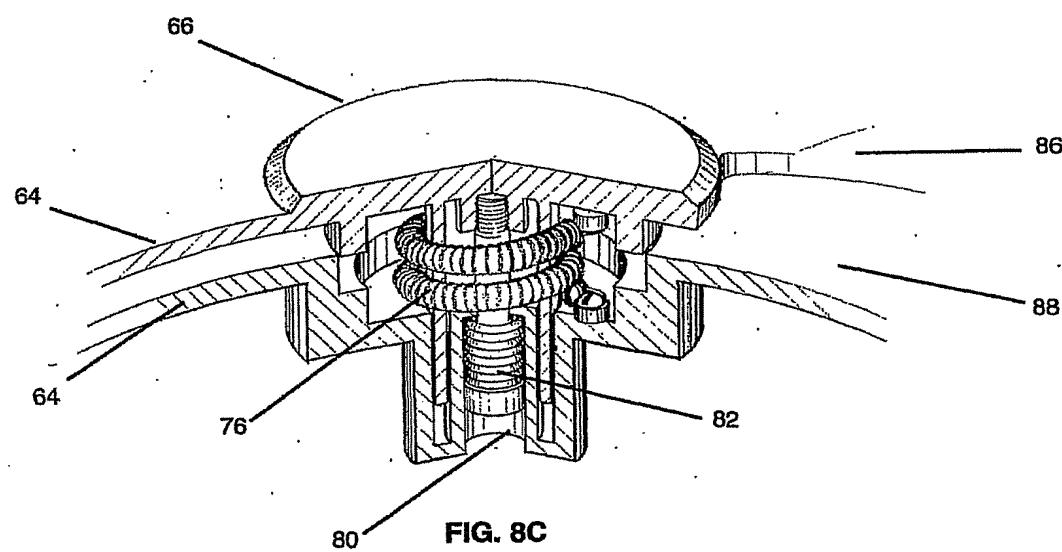


FIG. 8C

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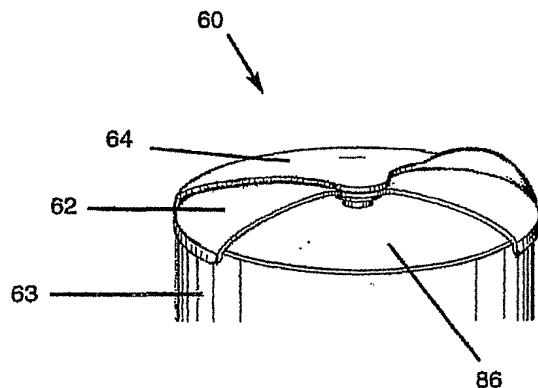


FIG. 9A

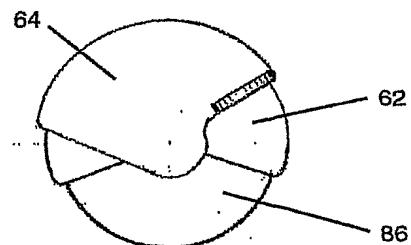


FIG. 9B

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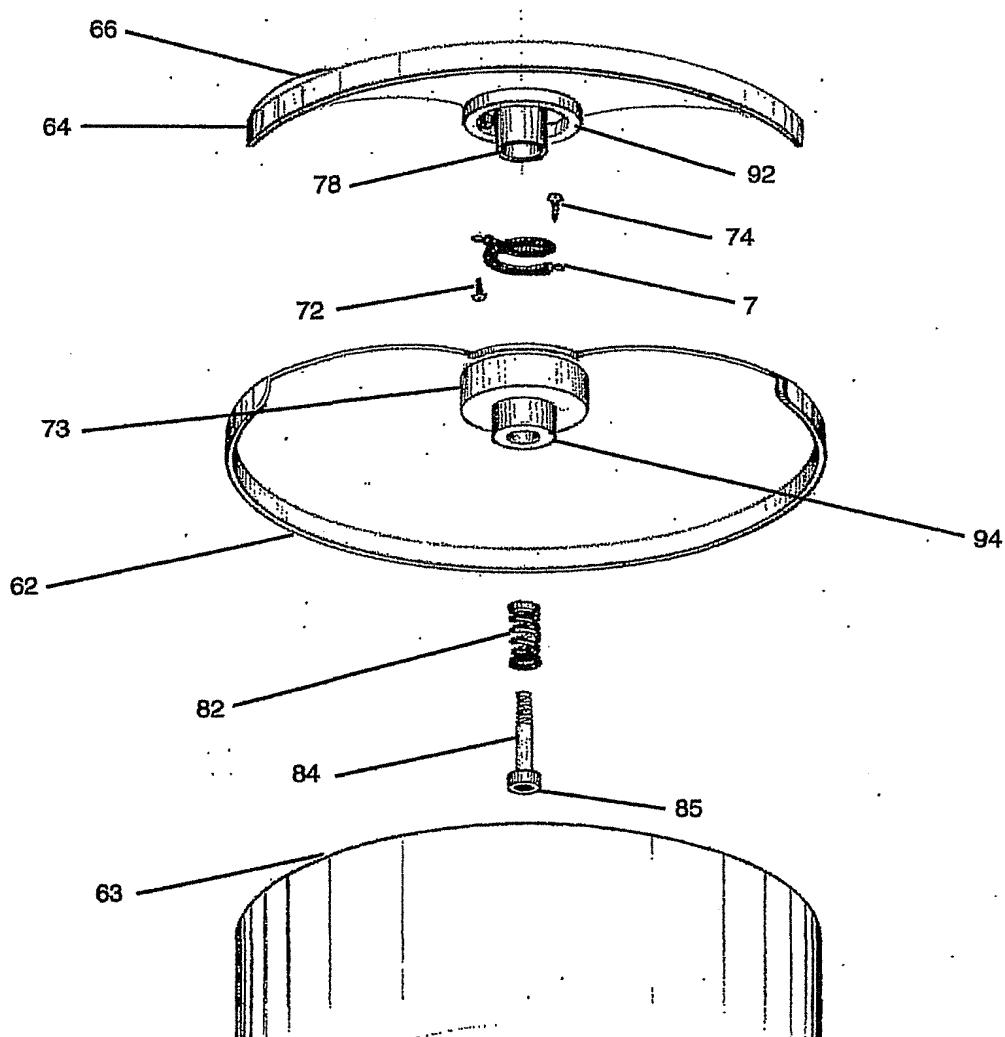


FIG. 10

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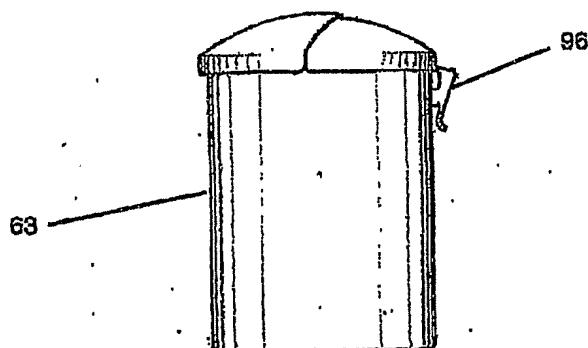


FIG. 11A

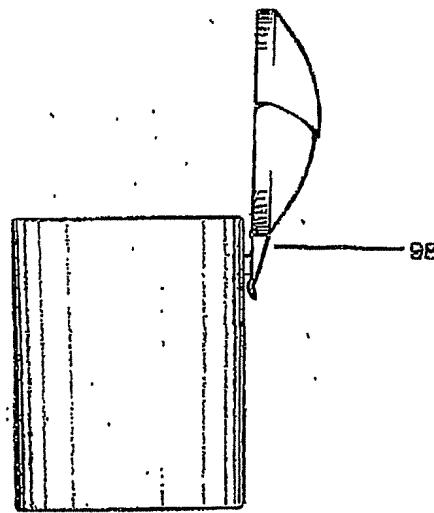


FIG. 11B

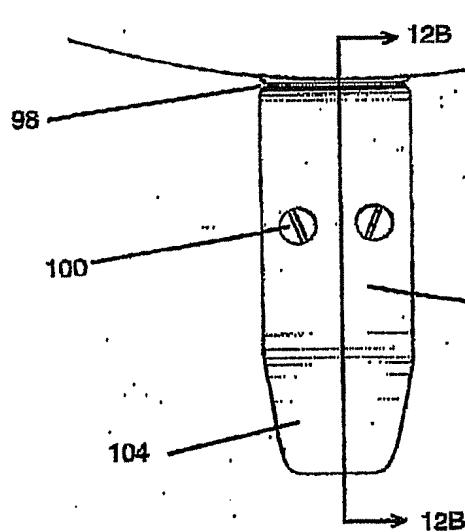


FIG. 12A

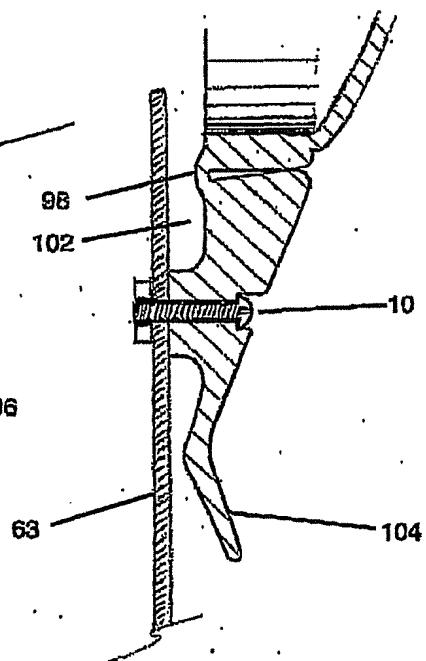
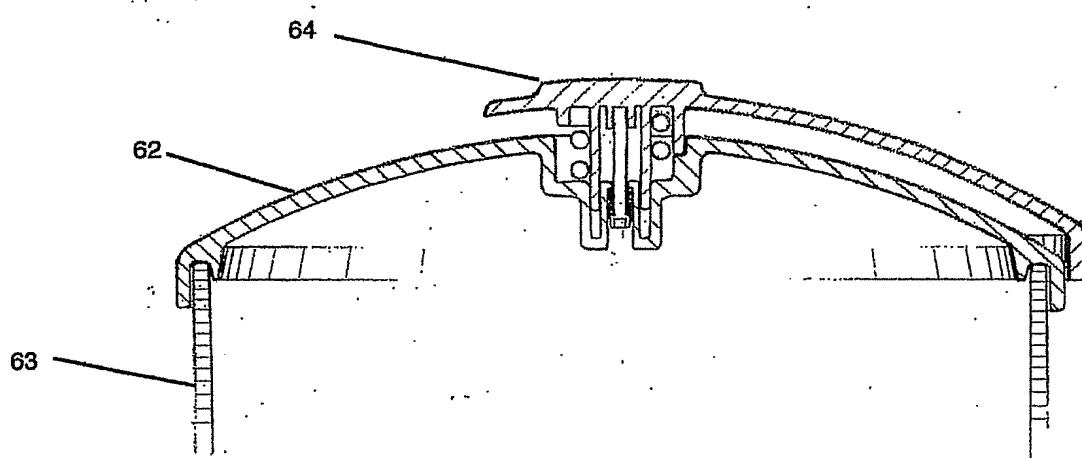
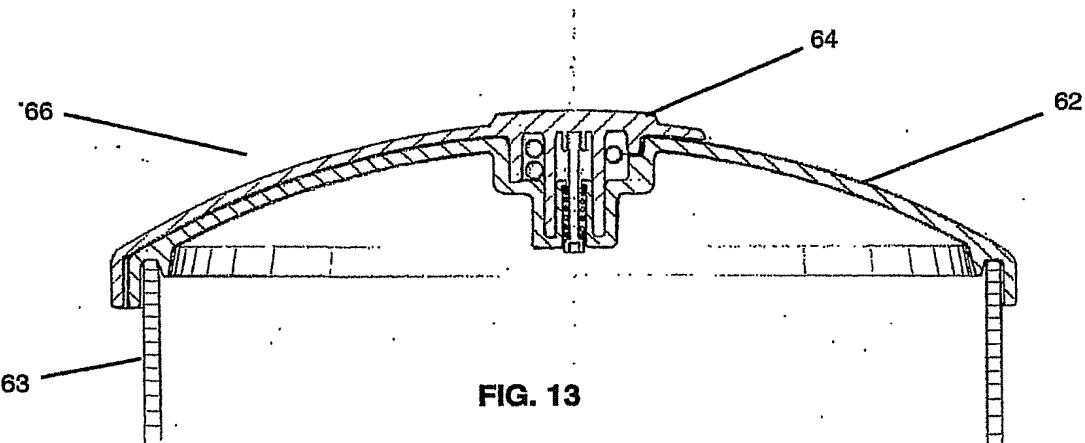


FIG. 12B

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SUBSTITUTE SHEET (RULE 26)

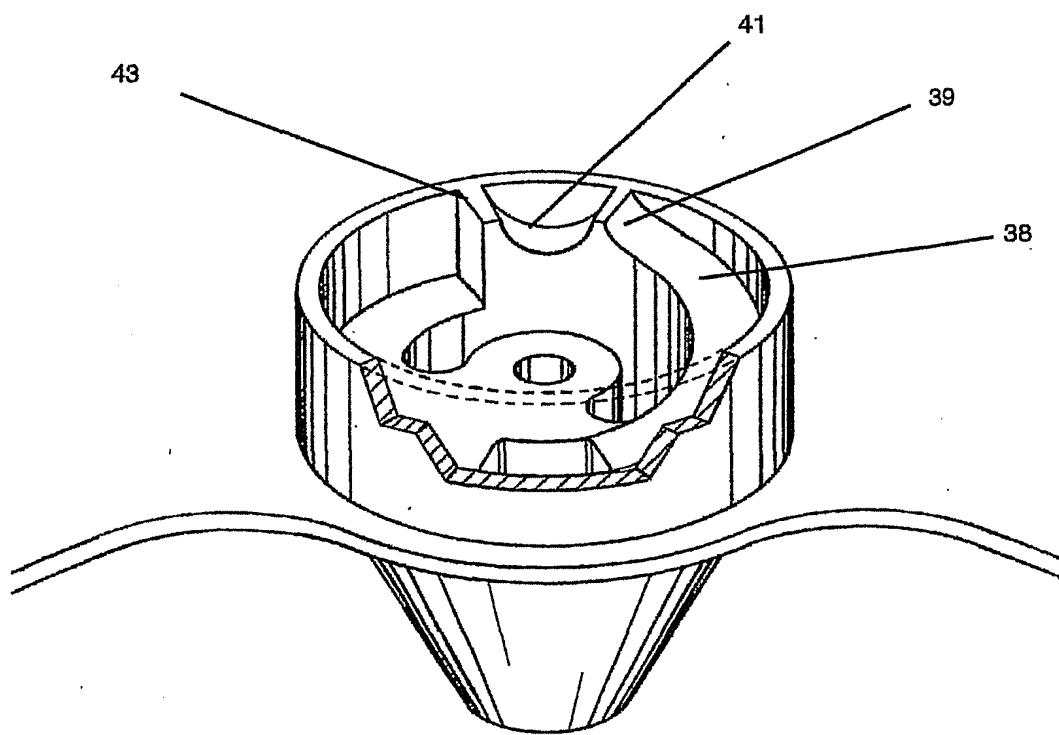
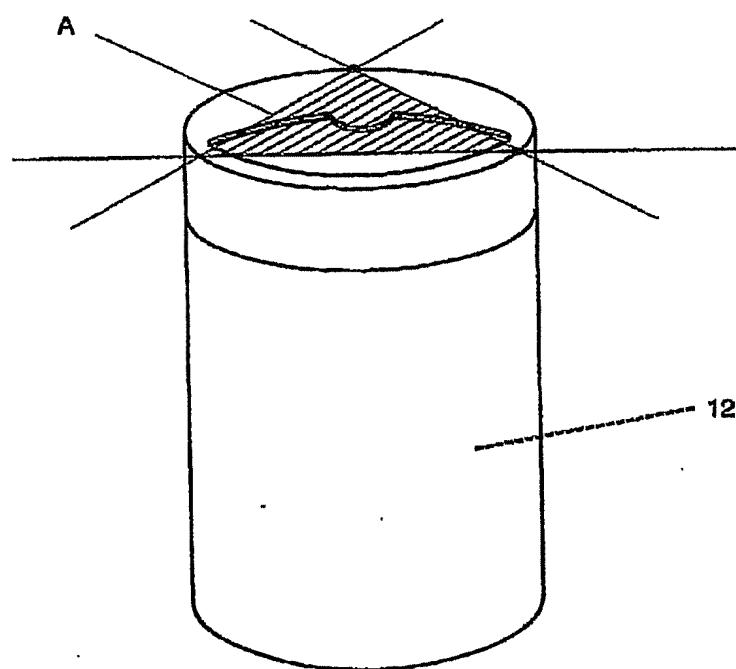


FIG. 15

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**FIG. 16****SUBSTITUTE SHEET (RULE 26)**

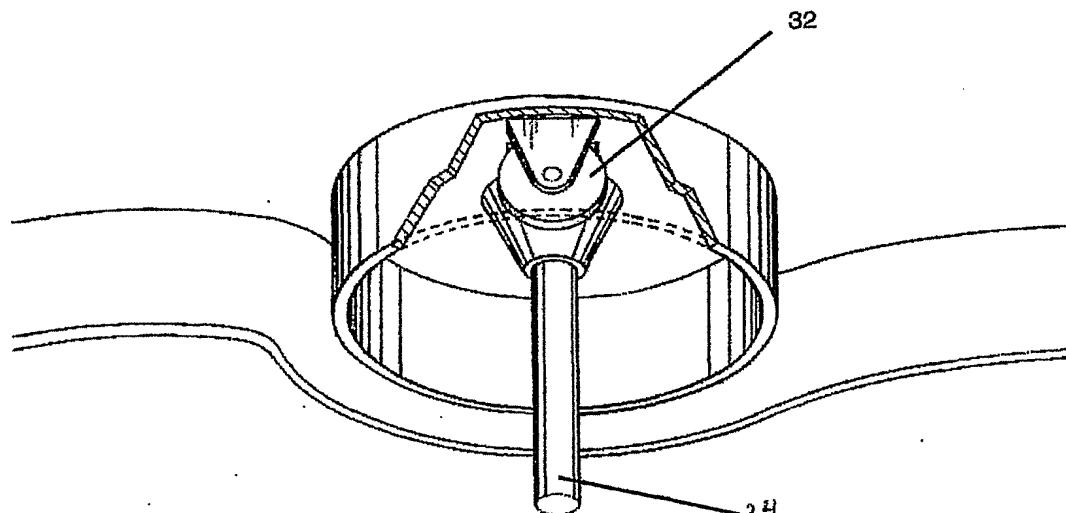


FIG. 17A

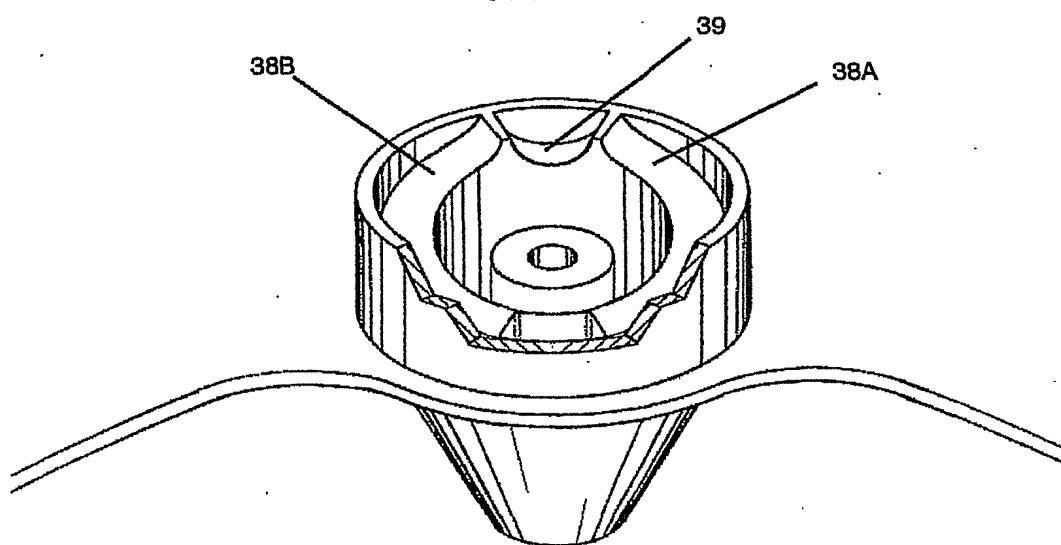


FIG. 17B

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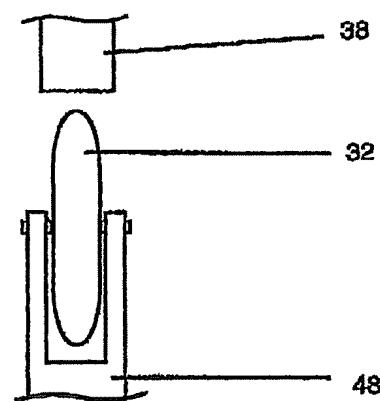


FIG. 18

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/21019

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B65D 43/18, 51/18
 US CL : 220/255, 256, 821; 222/557

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 U.S. : 220/255, 256, 821 823, 824; 215/236, 322 222/557, 546, 548, 554, 559, 560, 516

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,921,425 A (MARKEY) 13 July 1999, see entire document.	1-19
A	US 3,563,368 A (MCHUGH) 16 February 1971, see entire document.	1-19
A	US 1,998,373 A (LOVE) 16 April 1935, see entire document.	1-19
A	US 5,072,849 A (BLAU) 17 December 1991, see entire document.	1-19

<input type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input type="checkbox"/>	See patent family annex.
*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier application or patent published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 31 August 2001 (31.08.2001)	Date of mailing of the international search report 25 SEP 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer <i>Sheri Veney</i> Nathan J. Newhouse Telephone No. (703)-308-1148 <i>Paralegal Specialist</i> <i>Technology Center 3700</i>